**MOON PHASE AND ECLIPSE**

LAB REPORT – 75 pts.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Group #: \_\_\_\_\_\_\_\_

Period: \_\_\_\_\_\_\_\_

**OBJECTIVE:** To create models of the eight lunar phases and the different kinds of eclipses.

**QUESTION:** How can we represent the lunar phases we see from Earth during each month?

**HYPOTHESIS:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **(1 pt.)**

**MATERIALS:**

* Models of Earth, moon, and Sun
* Position sheet
* 4 Oreo cookies
* 1 plastic knife
* 1 paper plate
* Paper towel
* 1 large container of Play-Doh
* 1 small container of Play-Doh
* Metric ruler
* Sheet of notebook paper
* Flashlight
* 1 toothpick
* Colored pencils
* 1 lab report sheet per student

**INTRODUCTION:**

With the “Golden Age” of astronomy centered in Greece, several astronomers back then viewed the universe as **geocentric**, or Earth-centered. It wasn’t until later when astronomers, such as Copernicus, brought a **heliocentric**, or Sun-centered, view of the solar system to the forefront. The moon goes through phases as viewed from Earth due to the angle at which the Sun is reflecting light off of it. At times, a celestial body in space may block out another body, known as an **eclipse**. Common ones are the **solar eclipse**, when the moon comes between the Sun and Earth blocking some light from reaching Earth. The other is a **lunar eclipse**, when the Earth comes between the Sun and the moon casting its shadow on the moon. These eclipses vary due to the moon’s 5 degree orbital path around Earth.

**PROCEDURE:**

1. In the appropriate boxes below, draw detailed diagrams in color of the different models of our solar system, the geocentric model and the heliocentric model, making sure to label everything in each diagram. **(6 pts.)**

**GEOCENTRIC HELIOCENTRIC**

1. Johannes Kepler discovered 3 Laws of Planetary Motion. Describe those laws below: **(3 pts.)**

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Using Johannes Kepler’s 3rd Law of Planetary Motion, P2 = a3, calculate the orbital period, in terms of Earth years, for the planets of our solar system, including the dwarf planet, Pluto. The solar distance (a), also known as the semi-major axis, in terms of astronomical units (AU’s), is given for each planet in the chart below. **(9 pts.)**

|  |  |  |
| --- | --- | --- |
| **Planet** | **Solar Distance, *a*** | **Orbital Period, *P*** |
| Mercury | 0.39 |  |
| Venus | 0.72 |  |
| Earth | 1.00 |  |
| Mars | 1.52 |  |
| Jupiter | 5.20 |  |
| Saturn | 9.54 |  |
| Uranus | 19.18 |  |
| Neptune | 30.06 |  |
| Pluto\* | 39.44 |  |

\*As of 2007, Pluto is considered a dwarf planet and part of the Kuiper belt.

1. Set your position sheet up, placing the Sun model and Earth model in their appropriate places. Then place the moon model at position 1, with the white half of the moon facing the Sun, representing the half of the moon always illuminated (lit) by the Sun.
2. Separate your Oreo cookies carefully, so that one side of the cookie has **ALL** of the icing and the other side of the cookie has **NO** icing. Use your plastic knife if necessary to get the icing where you want it. You will continue using it to scrape off and add the icing for all of the moon phases.
3. Get in a position so you are at eye level with the Sun, Earth, and moon models and draw the phase of the moon, as seen from Earth, in the phase #1 spot on your moon diagram.
4. Now, represent this phase of the moon using an Oreo cookie. Since the 4 Oreo cookies are now separated into 8 individual cookies, each cookie will represent one of the 8 phases of the moon. Remember, WHITE = LIGHT. Therefore, the icing will represent the illuminated part of the moon, as seen from Earth. Place your completed Oreo cookie on the paper plate using the same positions from the moon diagram below.
5. Repeat steps 5 and 6 for the remaining phases of the moon until all 8 phases are drawn correctly in the moon diagram and all Oreo cookies represent the 8 phases of the moon on the paper plate. Once you have completed this, your instructor will grade your Oreo presentation.

**OREO PRESENTATION (8 pts.)**

*Instructor’s grade*

\_\_\_\_\_\_\_\_

**MOON DIAGRAM (8 pts.)**

2.

6.

7.

8.

1.

3.

4.

5.

1. Study the image below. On the diagram of Month 1, indicate the dark half of the moon on each of the 8 moon phases by shading the appropriate area with a pencil. Then, label the positions for all 8 phases of the moon. Do the same for Month 2. **(4 pts.)**



1. Using the image above, answer the following questions: **(5 pts.)**

After one complete revolution beginning at the new moon phase in Month 1, in what position is the moon located in Month 2?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Based on your above answer, does this position occur before or after the moon has completed one full cycle of phases? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In Month 2, what position represents the new moon phase? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Based on your above answer, when the moon reaches this position, will it have completed a synodic or sidereal month? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In your own words, explain the difference between a sidereal and synodic month.

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1. Retrieve your Play-Doh containers (large and small) and make one ball with a diameter of about 4 cm. using the large container of Play-Doh. This will represent the Earth.
2. Make another ball with a diameter of only 1 cm. This will represent the moon.
3. Place the two balls about 15 cm. apart on the sheet of notebook paper.
4. Put the toothpick in the smaller ball and hold it above the table slightly so the centers of the two balls are at the same level.
5. Hold the flashlight approximately 15 cm. away from the larger ball, with the smaller ball behind it. The flashlight and the two balls should be in a straight line. Keep the flashlight at about the same level as the Play-Doh.
6. When the whole class is ready, the instructor will turn out the lights.
7. Turn on your flashlight. Shine the light on the larger ball and sketch what you see in the space allotted for “Diagram 1”. In your drawing, be sure to include and label the following:

* Light coming from the flashlight representing the Sun.
* Ball of Play-Doh representing the Earth
* Ball of Play-Doh representing the moon
* Umbra
* Penumbra
* Type of eclipse

1. Move the flashlight to the opposite side approximately 15 cm. away from the smaller ball, with the larger ball behind it. Sketch what you see in the space allotted for “Diagram 2”. Again, in your drawing be sure to include and label the following:
   * Light coming from the flashlight representing the Sun.
   * Ball of Play-Doh representing the Earth
   * Ball of Play-Doh representing the moon
   * Umbra
   * Penumbra
   * Type of eclipse

**ECLIPSE DIAGRAMS (12 pts.)**

#1 #2

**LAB QUESTIONS (1 pt. each) –** *Please write your answers in* ***COMPLETE SENTENCES****!*

1. Differentiate between the heliocentric and geocentric views of the universe.

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1. What was the importance of the Ptolemaic System of the universe?

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1. What astronomer succeeded the late Tycho Brahe and carried out his works?

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1. Name Kepler’s 3 Laws of Planetary Motion.

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1. What was different about Galileo’s astronomical studies from previous astronomers?

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1. Differentiate between aphelion, perihelion, apogee, and perigee.

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1. As viewed from Earth facing the moon, during what moon phase would a lunar eclipse occur?

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1. As viewed from Earth facing the moon, during what moon phase would a solar eclipse occur?

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1. Explain why we can’t see the new moon phase from Earth.

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1. Define the term *synchronous rotation.*

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1. What was the name of the mission landing the 1st man on the moon?

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1. Who were the astronauts aboard that mission?

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1. What year did this mission occur?

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1. Who was the president giving the famous speech in 1961, making it a goal of the USA to land a man on the moon by the end of the decade?

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**CONCLUSION (5 pts.) –** *Write a solid paragraph (at least 5 sentences) about your conclusions from the lab. Discuss the steps you went through during your lab experiment, what you accomplished, and how you tested your hypothesis. Also include what you learned as a result of this lab experiment.*

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